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STRATEGIES FOR DESIGN DATA REUSAGE OVER THE PROPIETARY 3D DESIGN TOOLS

Darko Petkovic
University of Zenica
Faculty of Mechanical Engineering
ul. Fakultetska 1, 72 000 Zenica, Bosnia and Herzegovina

Stefano Tornincasa, Enrico Vezzetti
Dipartimento di Sistemi di Produzione
Politecnico di Torino
Corso Duca Abruzzi, 24-10129 Turin, Italy

ABSTRACT
Product design and manufacturing are all intrinsically collaborative processes. From conception and design on through to project completion and ongoing maintenance, all points in the lifecycle on any product involve the work of fluctuating teams of designers, suppliers and customers. For this reason companies are in the process of creating a distributed design and manufacturing environment that enables integrated product, processes, and protocols development, finding effective methods for communication and sharing of information throughout the entire enterprise and the supply chain. Actually the ownership of the 3D models management tecnologies is stiill linked with the 3D CAD propritary even if the new trend is moving in the direction of new standard and technologies based on World Wide Web platforms. This new tendency tryes to extend the life of 3D product data moving these design information downstream thorough the entire product lifecycle. Unfortunately the actual lack of a unique 3D web-based standard has stimulated the growing up of a lot of proprietary and open source standards and consequently a production of an incompatible information exchange over the WEB. The paper proposes a structured analysis of web-based solutions, trying to identify the most critical aspects to promote a unique 3D digital standard model capable of sharing product and manufacturing data more effectively - regardless of geographic boundaries, data structures, processes or computing environment.
Keywords: Collaborative design; Web3D, Virtual enterprise, Product lifecycle management.

1. INTRODUCTION
Businesses today face three on-going challenges: improving customer intimacy, achieving operational excellence, and providing product leadership. Improving customer intimacy requires understanding and responding quickly to current and potential customers, their needs, establishing effective relationships with them, and providing consist, long-term customer value. Achieving operational excellence requires enterprises to focus on operating efficiently, effectively, and flexibly, working with their partners to reduce the cost and time necessary to deliver high-quality products that meet their customer's requirements in a timely manner. Providing product leadership means delivering leadingedge products and solutions tailored to customer needs. All of these challenges require getting the right products to the right market, at the right time, for the right cost. To meet these challenges, businesses must become more innovative. However, being an innovative business doesn't simply mean creating innovative products. It also means improving the processes a company uses to produce its products and how it supports its products using innovative approaches to the complete product lifecycle[1]. Today, innovation is recognized as critical for a business to maintain its competitiveness in the marketplace. Innovation must be achieved while reducing overall product-related costs across

development, production, and service. A primary business driver is increasing product complexity and customization. Not only are mechanical configurations getting more intricate, products increasingly include complex electronics and software. In addition, customers want to have "their" product or plant configured to their individual specifications. The increase in product complexity, coupled with the desire for personalized configurations, requires an enhanced ability to quickly define new product variations and options, and to be able to manage the configurations being offered, Additionally, companies must manage the "entire" product or product family, integrating elements such as product recipes and packaging to meet regional requirements and regulations. This can best be accomplished through proper application of a **Product Lifecycle Management (PLM)** approach that addresses the needs of the extended enterprise [2,3]. PLM is a strategic business approach that applies a consistent set of business solutions in support of the collaborative creation, management, dissemination, and use of product definition information across the extended enterprise from concept to end of life—integrating people, processes and business systems. More than this, while product life is rapidly decreasing and product structure is more frequently changing and becoming more customer-oriented, manufacturing systems have become today complex and globalized. For this reason the factories have reduced the development and manufacturing production time and adopted an outsourcing approach. In fact the development and production of a product do not occur within a single manufacturing plane, but is becoming a joint venture between suppliers, manufacturers, distributors, and customers [4,5]. So, it becomes very important to manage the workflow harmoniously and to share information efficiently among geographically dispersed users. Starting from these necessities the new concept of collaboration focus its attention on tools for sharing information and knowledge in various divisions and for executing one's tasks cooperatively in order to improve product quality

2. WEB3D: PRODUCT LIFECYCLE REPURPOSING 3D DATA STRATEGIES

Actually these WEB tools, besides giving collaborative access to product data during its development, focus the attention of two new strategies. The first one works directly on 3D models trying to extend the life of 3D data moving these design information downstream through the entire product lifecycle. For every different phases of the product life this standard would allow a selective access on the virtual product information. The second one focus its attention on 2D documentation introducing 3D interactive information in order to add knowledge to drawings.

2.1. Web3D for extending life of 3D data

Focusing the attention on product lifecycle management the primary benefit of Web3D is that it allows CAD sourced 3D diagrams and animations to be shared, displayed and utilized outside of the proprietary CAD software products. This breaking of the "proprietary CAD barrier" opens the door to the use of 3D graphics and animations in a host of areas much later in the typical product lifecycle. Within engineering and manufacturing, 3D will still be primarily used, shared and viewed within the proprietary CAD software tools (Fig.1). Once a product has been manufactured, the bias of 3D use switches to Web3D solution. At this point, 3D graphics can be employed within a host of areas and activities. For instance, Web3D will enable the use of 3D graphics and animation in product beta and test marketing, marketing collateral and design-to order sales processes (most likely online). Web3D will also allows the inclusion of 3D product and component renderings within maintenance, support manuals and documentation. Of course, the value of including 3D graphics in marketing, training and maintenance materials varies from product to product. 3D provides tremendous value for visualizing and comprehending complex products like airframes, engines, medical equipment and industrial machinery, but provides little additional value over 2D for simple products like food or apparel. So, the value of Web3D is directly proportional to the complexity of the product being marketed or maintained (Fig.2). Equally, the size of the potential audience for the 3D graphics has a direct bearing on the value of providing them. If there is only a small audience, then the value and return on providing 3D graphics outside of proprietary CAD environments is relatively small, even for some complex products. However, if the audience is large, then the value of 3D, and therefore Web3D, increases exponentially.

While in some industries Web3D will have very little useful application, in others, like the auto industry, Web3D has the potential to be a disruptive technology, providing early adopters with significant competitive advantages. In industries that manufacture, service or maintain complex products with a large enough market segment, the significant short- and long-term cost savings that

can be realized from including 3D graphics within sales, training and maintenance literature will make Web3D an essential technology. Some consumer product manufacturers are also likely to start adopting Web3D relatively rapidly. Manufacturers of products that require consumer assembly or configuration (e.g. computers, home entertainment equipment, flat-packed furniture, etc.) will gradually transition to 3D electronic-format assembly instructions.

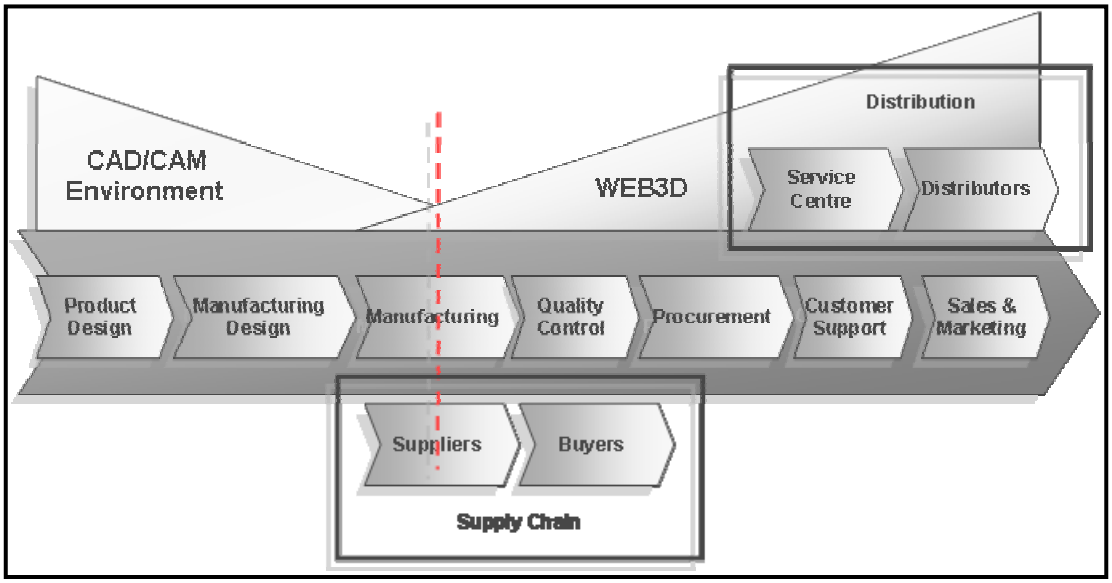

Figure 1.Relative value and areas of use across the product lifecycle

This will not only make life easier for the consumer, it will also reduce the manufacturer's support and return/replacement costs, providing a competitive advantage for early adopters (Fig.3).

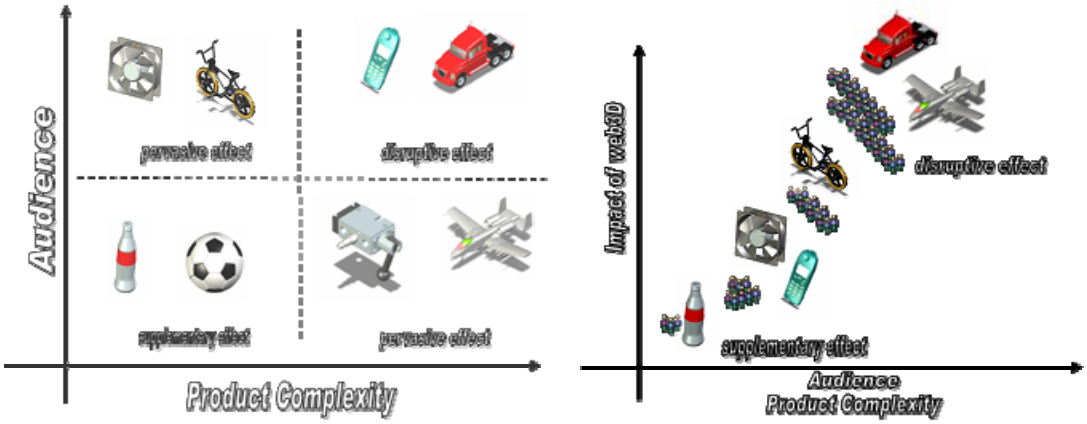

Figure 2. Value of a Web3D approach proportional to audience size and product complexity

Eventually, Web3D will become pervasive in all industries that market either complex or consumer products. Even when a product is not that complex, and does not require any kind of assembly, the inclusion of 3D within sales literature has the potential to increase sales[6,7]. Think of how much more engaging online product images will become with interactivity embedded in them. Following this idea some 3D tools providers have proposed their own solutions: **WEB3D-CDF**, **3Dif-U3D**, **Actify-3D, Solidworks–eDrw, Cycore-C3D, Viewpoint-mTx, RealityWave-XGL, Lattice3D-XVL, UGS-JT, Cimmetry-CMF, Tech Soft America-HSF.**

2.2. Web3D for improving 2D technical documentation

An alternative method that has been gaining popularity in recent years is for designers to recreate the current paper process in an electronic form using formats such as TIFF, JPEG, PDF, ... The drawback is that these electronic paper formats can't capture the intelligence within a design, and don't resolve the costly process issues of tracking, workflow, and accountability. Because they are capable only of presenting two-dimensional images of what are actually complex three-dimensional models, electronic paper formats lack the attributes necessary to serve as an effective medium for sharing design. Starting from Web based 3D technologies new standard are emerging that combines the convenience of electronic paper with the rich viewing, tracking, querying, plotting, printing, workflow, and security capabilities demanded by designers. This second Web3D approach wants to propose a medium for engineers to quickly capture and securely distribute rich design data anywhere it is needed-both within the design profession and beyond. These solutions enable the efficient distribution of rich design data to anyone who needs them. They protect the integrity of the designs, and allow for the precise publishing, rendering and printing of even the most complex 3D designs and models. In fact, unlike paper-centric file formats, they can convey the rich design intent of the original CAD model, thereby ensuring that the user is receiving exactly what the author intended[8,9,10]. Following this idea some information technology providers have proposed their own solutions: **Right-hemisphere-U3D, AutoDesk-DWF**

3. CONCLUSION

Introducing an effective Web3D visualization and collaboration solution into an organization's work flows, it can deliver tangible gains that are typically realized very rapidly, especially when it is part of a broad PLM initiative. Wide deployment of the right visualization and collaboration technologies can benefit those organizations that are wrestling with issues of file format incompatibilities, especially when product data and available software don't match, when the volume and variety of product data to be handled during the product lifecycle is rising, when there are virtual teams, where members are in different organizations and in geographically dispersed locations, when there are multidisciplinary and cross-functional teams, whose members have different expertise, ensuring the efficiency and effectiveness of communications within the enterprise, with suppliers, partners and customers and improving the quality and timeliness of decision making and also providing simple support material to maintenance, improving product customization tools for marketing personnel.

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